



Newsletter

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July - August 1986

DIRECTOR'S NOTE

Laboratory work in the Plant Science Building goes on year-round, and the summer season, with its active plant and animal growth, keeps scientists busy doing field work as well. We sample streams for organisms and nutrients, observe the effects of insects or pollutants on deciduous trees, and record gradual changes in the ecological balance, for example the recent discovery of the Lyme tick on the Arboretum (see cover story).

The Institute's public education program staff has begun creating outdoor research demonstrations so that our visitors will have the opportunity to learn about the scientific methods involved in field work. Plans are under way for high school science students to become involved in some of the field experiments themselves. The first of the demonstrations, dealing with acid rain, is nearly completed in its location behind the perennial garden at the Gifford House.

The IES Newsletter is published by the Institute of Ecosystem Studies at the Mary Flagler Cary Arboretum. Located in Millbrook, New York, the Institute is a division of The New York Botanical Garden. All newsletter correspondence should be addressed to the Editor.

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Ecology of the Lyme Tick

Wild mammals are hosts to a variety of parasitic organisms, some of which also feed on humans. One example of such a parasite is *Ixodes dammini*, a tiny tick that is commonly known as the 'deer tick,' or more accurately -- because deer are host to several species of tick -- the 'Lyme tick.'

The Lyme tick derives its name from a bacterial infection that it can carry: Lyme Disease. In 1975, in Old Lyme, Connecticut, a small epidemic was reported in which 39 children and 12 adults had an assortment of similar symptoms: skin lesions, arthritis, and cardiac and neurologic irregularities. Some epidemiological detective work turned up *I. dammini* as the vector of the 'Lyme Disease' agent. The agent itself was identified as a spiral-shaped bacterium, or spirochete, whose Latin name is *Borrelia burgdorferi*.

Ticks are arachnids, like spiders, with 8 legs as opposed to the 6-legged insects. The Lyme tick is much smaller than the dog or wood tick and is commonly found in thick brush but also lives in wooded and grassy areas. Its two-year life cycle has three stages. The larval stage hatches from eggs in the July - September period and attaches to a mammal for its blood meal. Satisfied in two to four days, it drops from the host and molts sometime during the following winter or early spring months to become a nymph. The nymph looks for its blood meal during the May - August period, drops off and molts to the adult stage. Adult females feed, again only once, during that fall or, if warm weather periods permit, during the winter or spring; the adult male does not feed but mates with the female while she is feeding. Eggs are laid -- it is not known exactly

where -- in the spring and hatch a few months later, starting the cycle again.

Larval ticks are not born carrying Lyme Disease but can ingest the bacterium during their first blood meal if they happen to attach to a previously infected mammal. The infected larvae then molt to the nymph stage, which is capable of transmitting the infection to its new host. Since the nymph emerges before the larvae in any given year, the potential for larval infection increases each year. The nymph, only the size of the period at the end of this sentence in its unengorged state, appears to be the stage which is most apt to infect humans. The adult, also capable of transmitting the disease, seems to have a preference for deer as a host, though humans are not immune from their bites.

In 1984, Institute of Ecosystem Studies wildlife ecologists initiated a research project to look for the presence of the Lyme tick on mammals on the Arboretum. It was suspected that this species of tick, which was spreading rapidly from the coastal areas of New England inland and northward, would eventually make its way to Dutchess County. Because of the area's dense deer population, and because of the routine monitoring done at the Arboretum on resident mammal species, this was a prime spot for early detection of the Lyme Disease bacterium. That year 60 deer were necropsied during the hunting season: 14% had Lyme ticks, with an average of 2 per infested deer. No spirochetes were found.

The bacterium was detected, however, in 1985 as routine sampling of wild animals continued. The host animals of the two

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Small mammals on the Arboretum are being monitored to learn the distribution of the Lyme tick. Here, summer students are assisting IES Wildlife Research Assistant Rob Hossler in the collecting and recording of data from a white-footed mouse. Left to right: David Shoemaker, Karen Wagner, Michele English (using a straw to blow the animal's fur so that ticks can be found more easily) and Rob Hossler.

Lyme tick, *from page 1*

infected nymphs were a white-footed mouse and an opossum, and this discovery marked the first time in the 10-year history of the disease that the presence of the bacterium in an area was noted before any human cases were recorded. When deer were examined in the fall of 1985 a four-fold increase in the numbers of Lyme ticks was found: over 40% of the deer had ticks, with an average count of 9 per infested animal. Once again, no spirochetes were detected in blood samples collected from the deer.

By discovering the presence of the disease agent in Dutchess County before Lyme Disease becomes established, IES scientists are in a unique position to learn about the ecology of the mammal/Lyme tick/spirochete complex. Such research is much more difficult in areas where there already exists a large population of infected ticks, infected mammals and a disease of epidemic proportions. IES Wildlife Ecologist Jay McAninch and his assistant, Rob Hossler, are taking advantage of their head start on the disease: by knowing what to observe they are attacking a number of questions to determine what factors control the population growth of both the tick and the bacterium.

What percentage of the ticks in a geographical area are attached and how many are 'questing' for a host at any given time? Techniques for determining the

number of questing ticks in an area are not yet perfected, but one, known as 'man-baiting,' could prove useful in learning about how ticks make contact with humans. Man-baiting has researchers walking slowly through suspected tick habitats in order to attract and then count the ticks. In Westchester a variation of this method once resulted in a collection of 155 ticks on one person! Recently two IES scientists, dressed all in white down to white socks pulled over their shoes, walked at a regulated speed across two grids on the Arboretum property; the grids selected were areas where the most ticks have been counted on smaller mammals. Their man-baiting attempts attracted no ticks, suggesting that the number of arachnids is still very low.

What is the pattern and rate of spread of the Lyme ticks over both small and large areas? The scientists have established four intensive study grids, monitoring 100 different stations on each, to observe the ticks' small scale movement patterns. To discover larger movement patterns across the Arboretum they will also monitor 40 smaller areas. Information on how ticks move on these two scales can be used to predict how they move from one neighborhood to another, and also how they move within the realm of a backyard. These data should help to establish how ticks are transported to where they will come into contact with people.

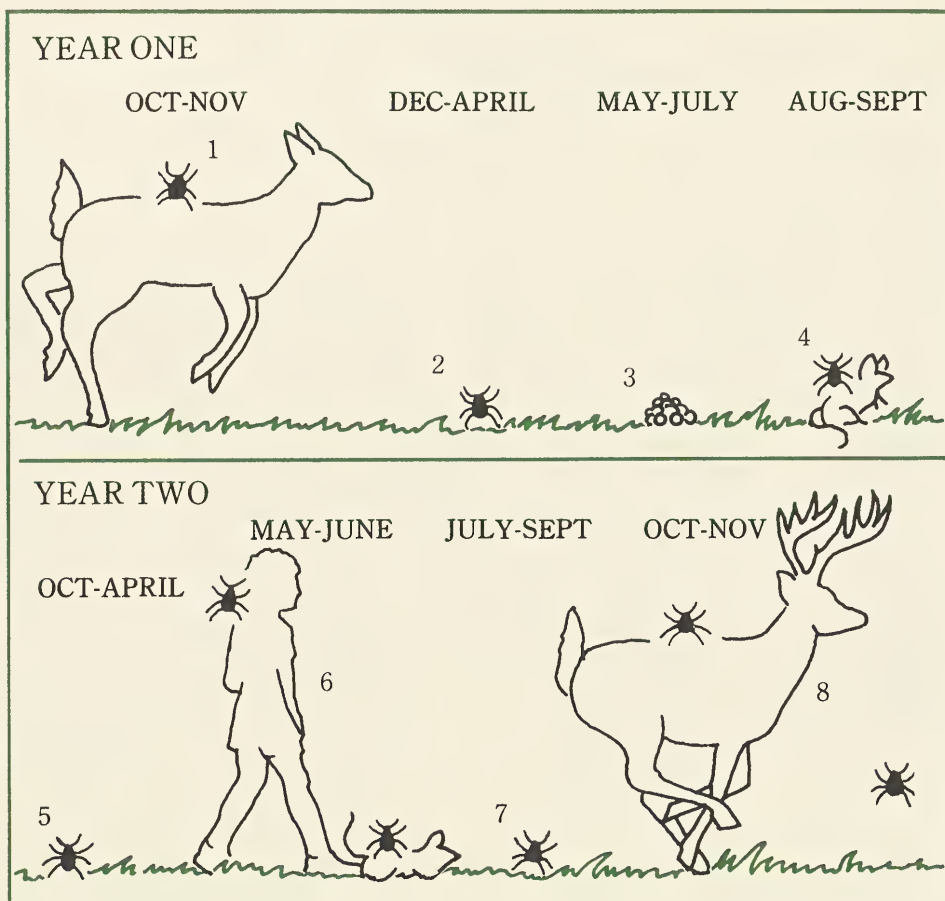
What is the relationship and importance of various mammalian hosts to the tick

population? The research team has been observing mammalian hosts to learn their roles during the three stages in the ticks' life cycle -- for example, does each stage infect any mammal that happens by, or are the ticks selective? On the four intensive grids, McAninch and Hossler, assisted this field season by summer students Dave Shoemaker, Michele English and Karen Wagner, will examine resident mammals by catching them in livetraps. Before returning the animals, unharmed, to their home territories, the team will collect ticks and take blood samples to have sera tested for Lyme Disease antibodies. Be determining if any of the mammal species are especially attractive to ticks, the ecologists can evaluate the potential effectiveness of control strategies.

In some areas there has been a call for more deer kills, since deer appear important as hosts for adult ticks. Studies such as those at IES reveal the ecological structure and great complexity of the Lyme tick problem -- for example, if the deer population were significantly cut back, the tick might well move to an alternate host without any reduction in numbers. Research suggests that a variety of integrated control measures will more likely be the best solution.

Perhaps the tiny parasitic Lyme tick cannot distinguish between its wild mammalian hosts ... and it would follow that it cannot distinguish between wild mammals and man. This example is but

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The life cycle of the Lyme tick

- 1) Adults feed and mate, typically on white-tailed deer.
- 2) Adults fall off. Female lays her eggs and adults die.
- 3) Eggs most likely rest in leaf litter or in grass -- exactly where is not known.
- 4) Eggs hatch to larvae. Larvae quest for hosts -- the white-footed mouse is 'preferred.' If the mice are infected with the Lyme Disease bacterium, the larval ticks can become carriers.
- 5) After a 3-4 day blood meal, the larvae fall off. Sometime during the fall-winter period the larvae molt to nymphs.
- 6) Nymphs take their one blood meal on a wild mammal such as a white-footed mouse, or on a human. If the ticks were infected during their larval feeding, they can pass the bacterium on to this new host. After approximately 4 days, the nymphs drop off.
- 7) Nymphs molt into adults.
- 8) Adults quest for a host, feed, mate ... and the life cycle begins again.

Summer Staff at the Institute

During the summer months the IES staff grows. Scientists and graduate students come here to do their own research in our laboratories. High school and college students are also hired to assist staff scientists with their research projects, and to work with operations and Display Gardens staff on jobs involving the buildings and grounds.

Name — Project Description

Front (left to right):

Dave Behrens — Grounds maintenance
Michele English — Vectors/Lyme Disease
Carl White — Nitrogen mineralization
Jenny Hendler — Cottonwood project
Roshan Mistry — Rainwater analysis

Back (left to right):

Harold Fraleigh — Vegetation/rights-of-way
Karen Wagner — Vectors/Lyme Disease
Stephen Baines — Microbial ecology
David Shoemaker — Vectors/Lyme Disease;
Coyote & dog predation on sheep
Civia Snow — Perennial Garden
Annette Logan — Gypsy moth defoliation
Peter Skura — Gardening & transplanting
Pat Cleveland — Cottonwood leaf chemistry
Ellen Jacquart — Research demonstrations



EMIL KELLER

Not in the photographs:

Martin Burd — Vegetation/rights-of-way
Ruth Engle — HBES: water chem./microbiol.
Helen Forgione — NYBG Forest Project
Andrea Kirn — Cottonwood propagation; Insect rearing
Alcinda Lewis — Butterfly feeding/learning
Richard Lounsbury — Greenhouse; plant care
Everett Marshall — Vegetation/rights-of-way
Benjamin Peierls — HBES; nutrient fluxes
Edward Roy — NYBG Forest Project

Name — Project Description

Front (left to right):

Caryn Roelofs — Gypsy moth defoliation
Lauren Atherly — Masonry, painting, etc.
Nadine Bloch — Hudson intertidal zone; East Branch Wappinger Creek
Liz Stivers — Fern Glen renovation
Carol Hillhouse — Plant competition

Back (left to right):

Patrick Riley — Gardening & transplanting
Kay Austin Gill — Bacterial metabolism;
Carbon mineralization/sediments
Norman Tengstrom — Maint. grid system etc.
George Claiborne — Analysis & programming
Cathy Snygg — Fern Glen renovation
Alan Zytowski — Carpentry, painting, etc.
Charles Riccio — Perennial Garden
Thomas Arsuffi — Fungal/bacterial growth
Mark Vose — Carpentry, masonry, etc.



EMIL KELLER

Lyme tick, *from page 2*

one of many illustrating the human role -- willing or unwilling -- in functioning ecosystems. By obtaining data on the ecology of the Lyme tick, the Institute will begin to understand more about such relationships and also will be in a better position to help guide managers and decision makers who are dealing with public health questions related to Lyme Disease.

* * * * *

"The Ecology of Lyme Disease" will be the subject of the November 2nd IES Sunday Ecology Walk/Talk, when Jay McAninch will describe his research in a slide presentation. The free program will begin at 2:00 p.m. in the Gifford House.

* * * * *

IES has printed a brochure, "Facts about Lyme Disease for Arboretum Visitors"

which is available at the Gifford House and the Plant Science Building. IES wildlife ecologists are investigating the ecology of Lyme Disease and its mammalian hosts. The scientists are not trained in public health matters and cannot assist in questions of risk, diagnosis or tick identification. Questions regarding Lyme Disease and human health, as well as questions about the ticks themselves, should be directed to your local health department.

Volunteering at IES

The Institute is proud of its 65 active volunteers, and happily accepts new ones. These workers assist in all areas of IES operations -- from the Greenhouse and Gift Shop to the Wildlife Lab and the Plant Science Building laboratories and library -- earning the respect and appreciation of all the staff for their willing and hard work. Benefits include receipt of the IES Newsletter, free enrollment in one Adult Education course each term, discounts at the Gift Shop and recognition of service at an annual volunteer banquet.

At the 1986 banquet, special awards for working 100 hours or more during 1984-85 went to Michelle Beck, Faith Bennett, William Bunch, Martha Kappel, Helen Meurs, Sally O'Brien, David Smith, Norman Tengstrom and Helen Vagts. Mr. Tengstrom, a high school student, received special mention for volunteering 476 hours in the Wildlife Lab.

Information on becoming an IES volunteer may be obtained at the Gifford House, or by calling (914) 677-5358.

Note to Members:

Our membership office plans a promotional mailing for new members this fall. If you receive this letter inadvertently, we hope you will pass it along to a friend.

Fall Calendar

COURSES

Fall Adult Education Program courses in landscape design, gardening and botany will begin in mid-September:

- Landscape Design Theory
- Graphics
- Landscape Design III. Planting Design
- Construction II. Site Detailing
- *Surveying for Landscape Design
- *Fundamentals of Gardening
- Soil Science
- *A Beginner's Course in Growing Fruits
- Commercial Greenhouse Management
- *Herbs for All Seasons
- *Diseases of Ornamental Plants
- *Pruning Trees and Shrubs
- Identification of Higher Fungi
- Basic Botany
- * Indicates courses which are new or revised for our program this fall.

In addition, special crafts courses will be offered in November and December. A listing will be included in the next IES Newsletter, or you may call for information.

Catalogues have been sent to all members and previous course participants. If you are not already on our mailing list and would like to receive a catalogue, call the Gifford House at the number below.

ECOLOGICAL EXCURSIONS

Space still remains in the following fall excursions:

- Island and Marine Ecology in Bermuda
- Hudson River Ecology Cruise
- Forest and Lake Ecology at Mohonk Mountain
- Catskill Mountain Ecosystems
- Estuarine Ecology: Canoe Exploration of Constitution Island Marsh

For details and registration information call the number below.

SUNDAY PROGRAMS

Public programs are offered on the first and third Sunday of each month. All programs run from 2:00-4:00 pm and start at the Gifford House unless otherwise noted. They are open to everyone at no cost.

Tentative schedule (please call the number below to confirm the day's topic):

- September 7th, A stream walk (S. Findlay)
- September 21st, Air Quality and the Forest (G. Lovett)
- October 5th, Monitoring the Environment (J. Eaton)
- October 19th, Interpreting the History of New England Woodlots (C. Canham)
- November 2nd, The Ecology of Lyme Disease (J. McAninch)

ART EXHIBITIONS

From time to time artists exhibit their works in the lobby of the Plant Science Building. These exhibits are open to the public on weekdays from 8:30-4:30. Admission is free.

- August 24th - October 10th -- "Fescues & Lagers" by Ray Donarski.

ARBORETUM HOURS

Monday through Saturday, 9 a.m. to 4 p.m.; Sunday, 1-4 p.m. The Gift and Plant Shops are open Tuesday through Saturday 11 a.m. to 4 p.m.; Sunday 1 - 4 p.m. Closed on public holidays. All visitors must obtain a free permit at the Gifford House for access to the Arboretum.

MEMBERSHIP

Take out a membership in the Mary Flagler Cary Arboretum. Benefits include a special member's rate for IES courses and excursions, a 10% discount on purchases from the Gift Shop, six issues of the IES Newsletter each year, free subscription to *Garden* (the beautifully illustrated magazine for the enterprising and inquisitive gardener) and parking privileges and free admission to the Enid A. Haupt Conservatory at The New York Botanical Garden in the Bronx. Individual membership is \$25; family membership is \$35. For information on membership, contact Janice Claiborne at (914) 677-5343.

Note: Your membership contribution to the Mary Flagler Cary Arboretum is eligible for the IBM Matching Grants Program for Hospitals and the Arts.

For more information, call (914) 677-5359 weekdays from 8:30 - 4:30.

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